

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(PCT Rule 71.1)

To:

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Date of mailing
(day/month/year)

28.01.2011

Applicant's or agent's file reference
P107888.WO.01

IMPORTANT NOTIFICATION

International application No.
PCT/IB2009/007443

International filing date (day/month/year)
28.10.2009

Priority date (day/month/year)
30.10.2008

Applicant
Pursuit Dynamics PLC.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary report on patentability and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary report on patentability. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

The applicant's attention is drawn to Article 33(5), which provides that the criteria of novelty, inventive step and industrial applicability described in Article 33(2) to (4) merely serve the purposes of international preliminary examination and that "any Contracting State may apply additional or different criteria for the purposes of deciding whether, in that State, the claimed inventions is patentable or not" (see also Article 27(5)). Such additional criteria may relate, for example, to exemptions from patentability, requirements for enabling disclosure, clarity and support for the claims.

Name and mailing address of the international
preliminary examining authority:



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PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P107888.WO.01	FOR FURTHER ACTION		See Form PCT/PEA/416
International application No. PCT/IB2009/007443	International filing date (day/month/year) 28.10.2009	Priority date (day/month/year) 30.10.2008	
International Patent Classification (IPC) or national classification and IPC INV. C12P7/10			
Applicant Pursuit Dynamics PLC.			
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of <u>7</u> sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> <i>sent to the applicant and to the International Bureau</i>) a total of <u>11</u> sheets, as follows:</p> <p style="margin-left: 40px;"><input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p style="margin-left: 40px;"><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> <i>(sent to the International Bureau only)</i> a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see paragraph 3bis of Annex C of the Administrative Instructions).</p>			
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the report</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input type="checkbox"/> Box No. VIII Certain observations on the international application</p>			
Date of submission of the demand 2010-11-08		Date of completion of this report 28.01.2011	
Name and mailing address of the international preliminary examining authority:  European Patent Office Gitschiner Str. 103 D-10958 Berlin Tel. +49 30 25901 - 0 Fax: +49 30 25901 - 840		Authorized officer Schröder, Gunnar Telephone No. +49 30 25901-326 	

**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/IB2009/007443

Box No. I Basis of the report

1. With regard to the **language**, this report is based on
- ☒ the international application in the language in which it was filed
 - ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of:
 - ☐ international search (under Rules 12.3(a) and 23.1(b))
 - ☐ publication of the international application (under Rule 12.4(a))
 - ☐ international preliminary examination (under Rules 55.2(a) and/or 55.3(a))
2. With regard to the **elements*** of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

Description, Pages

1-38 as originally filed

Claims, Numbers

1-44 filed with telefax on 19-01-2011

Drawings, Sheets

1/8-8/8 as originally filed

- ☐ a sequence listing - see Supplemental Box Relating to Sequence Listing.

3. ☒ The amendments have resulted in the cancellation of:
- ☐ the description, pages
 - ☒ the claims, Nos. 45-74
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):
 - ☐ any table(s) related to sequence listing (*specify*):
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since either they are considered to go beyond the disclosure as filed, or they were not accompanied by a letter indicating the basis for the amendments in the application as filed, as indicated in the Supplemental Box (Rules 70.2(c) and (c-bis)):
- ☐ the description, pages
 - ☐ the claims, Nos.
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):
5. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 70.2 (e)).
6. ☐ Supplementary international search report(s) from Authority(ies) have been received and taken into account in drawing up this report (Rule 45bis.8(b) and (c)).

**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/IB2009/007443

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	<u>1-44</u>
	No: Claims	
Inventive step (IS)	Yes: Claims	<u>1-44</u>
	No: Claims	
Industrial applicability (IA)	Yes: Claims	<u>1-44</u>
	No: Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following documents:

- D1 GB 1 028 211 A (ESCHER WYSS GMBH) 4 May 1966 (1966-05-04) ; & GB 995 660 A (ESCHER WYSS GMBH) 23 June 1965 (1965-06-23)
- D2 WO 2006/010949 A1 (PURSUIT DYNAMICS PLC [GB]; FENTON MARCUS BRIAN MAYHALL [GB]; WALLIS AL) 2 February 2006 (2006-02-02)
- D3 Cincotta, Bruce: "From the lab to production:direct steam injection heating of fibrous slurries"BIOMASS MAGAZINE 1 July 2008 (2008-07-01) , XP002593580Retrieved from the Internet:URL:http://www.pro-sonix.com/files/Heating_of_Fibrous_Slurries_-_Biomass_Magazine_-_Hyp_0708.pdf [retrieved on 2010-07-22]

1 Novelty

1.1 The subject-matter of claims 1-44 is novel in the sense of Art. 33(2) PCT.

1.2 The document D1 (GB 1,028,211) is regarded as being the prior art closest to the subject-matter of claim 1, and discloses (the references in parentheses applying to this document):

A process for the treatment of a starch -based feedstock (page 1, lines 8-20), comprising:

(a) inducing a composition comprising biomass (starch, or a starch based feedstock) and a working fluid (water) to flow into a passage of a fluid processing apparatus (Figure 1, vessel 4; page 2, lines 7-22; example 1, page 3, lines 24-25);

(b) injecting a high velocity transport fluid (pressurized steam) into the composition, thereby imposing high stress due to impacting and shearing forces (page 2, lines 13-22);

(d) transferring the composition to a first holding vessel (reaction vessel 61, Figure 1 and page 2, lines 33-37);

(e) holding the composition in the first holding vessel at a predetermined temperature for a predetermined time (page 2, lines 33-43 and 63-68; example 1),

wherein a liquefaction enzyme (alpha-amylase) is added to the composition prior to step (a) (page 2, lines 13-22; example 1, page 3, lines 16-24);

The document GB 995,660 is cited in the document and is said to disclose the apparatus suitable for carrying out the above step (b) of the process (see page 1, lines 22-32).

GB 995,660 discloses:

An apparatus for injecting a high velocity transport fluid into a starch slurry through a nozzle communicating with the passage of a starch activation device (page 2, lines 9-50 and claims 1-3).

The further described features in steps (b) and (c) of claim 1 (atomisation, vapour and droplet flow regime, condensation) are considered to be the result of applying the injection of pressurized steam into the biomass slurry, as disclosed in document D1, and are thus regarded to be an implicit feature of the process of document D1.

- 1.3 The subject-matter of claim 1 therefore differs from this known process in that, in addition to an amylase enzyme, a cellulase enzyme is added to the composition prior to or during the process. It is noted that, although the document D1 refers to the use of a "carbohydrase" in the process, this term designating generally enzymes catalyzing the hydrolysis of carbohydrates, the more specific enzyme (enzyme complex) "cellulase" is not disclosed, and in the context of the process which concerns the conversion of starches into sugars, the skilled person would understand the use of amylases but not the use of a cellulase (the cellulase converting cellose into sugars).

The subject-matter of claim 1 and of dependent claims 2-43 is therefore new (Article 33(2) PCT).

- 1.4 The independent claim 44 concerns a process for producing bioethanol which comprises the same process steps (a)-(e) as in claim 1. The subject-matter of claim 44 is therefore also new.

- 1.5 Documents D2 and D3 (passages cited in the search report) disclose further methods for treating biomass by steam injection. These documents will be used to discuss the presence of an inventive step further below.

- 1.6 Document D2 discloses a method and apparatus for mixing and homogenizing fluids by direct steam injection. The apparatus is said to be suitable for pretreating biomass for subsequent bioethanol production, and it is said to be suitable for use in an enzymatic hydrolysis process without damage to the enzymes (page 47, line 28 - page 48, line 32).
- 1.7 Document D3 is an article wherein there are highlighted the advantages of direct steam injection as a pretreatment method for the conversion of biomass into sugar and bioethanol. In particular, the advantage of a high velocity steam injection at sonic velocity to achieve "choked flow" for optimum biomass pretreatment is described (see last page of D3).

2 Inventive step

- 2.1 The subject-matter of claims 1-44 is considered to involve an inventive step in the sense of Article 33(3) PCT.

Document D1, which is considered to represent the most relevant state of the art, discloses a process from which the subject-matter of claim 1 differs in that a cellulase enzyme is added to the composition prior to or during the process.

The technical effect of this difference is the possibility to simultaneously hydrolyse both the starch and the cellulose comprised in the biomass in an efficient way.

The problem to be solved by the present invention may be regarded as the provision of an improved process for the treatment (hydrolysis) of biomass.

The solution to this problem proposed in claim 1 of the present application is considered as involving an inventive step (Article 33(3) PCT) for the following reasons:

As stated above, the process of document D1 is not concerned with cellulose hydrolysis. It was non-obvious for the skilled person to include a cellulase and to conduct the hydrolysis of starch and cellulose simultaneously.

Similarly, the skilled person would not be directed to use both an amylase and a cellulase in the biomass treatment disclosed in document D2 since the document does only mention the possibility to use an "enzyme" in general. Although the use of a cellulase is evident from the fact that it is intended to hydrolyse "plant matter" (see page 48, lines 19-32, specifically lines 27-28), there is no indication to use both an amylase and a cellulase prior or during the process.

Finally, document D3 is not concerned with the possibility of introducing enzymes during or prior to the pretreatment which involves direct steam injection, let alone the use of both an amylase and a cellulase before or during the treatment.

- 2.2 Claims 2-43 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to inventive step.
- 2.3 Claim 44 comprises the same process steps (a)-(e) as in claim 1. The subject-matter of claim 44 is therefore also considered to be inventive.